STAR Detector Environmental Information for FY2003 Physics Run

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Introduction

This document lists information concerning the various gases and liquids used for the operation of the STAR detector for the FY2003 Physics run. The FY2003 Physics run is expected to start on or about January 1, 2003, and run continuously until on or about May 15, 2003.

Time Projection Chamber (TPC)

Gas system:

Main TPC gas is P10 (10% Methane, 90% Ar)

Purge flow rate = 120 lpm for a total of 3 volume exchanges (TPC volume = 50,000 l). This Purging process will likely take place once in November 2002 and once in January 2003. If necessary, this purging process could occur again sometime during the physics run.

Normal recirculating flow = 560 lpm with 14 lpm vented out the stack (stack located on the east wall of the STAR assembly building with the vent exit above the level of the berm retaining wall.)

This year a large liquid Argon storage dewar has been installed at STAR to supply gas to the TPC and the FTPC. When the tank has liquid Argon in it, and the gas systems are not in operation, it is estimated that the boil off rate from the dewar is approximately 10 lpm. This 10 lpm is vented to the atmosphere.

Insulating gap gas is N2 - flow rate is 10 lpm out the vent stack.

N2 is also used in various places in the gas system, laser system and water system - total flow ~ 50 lpm vented to the room.

Water cooling - the TPC FEE & RDO are cooled by a closed loop water cooling system. Heat exchange is to the STAR MCW. The total volume of the TPC water system is ~500 gallons and the flow rate is ~320 GPM. The system is located in the second floor utility room at STAR. No water is released to the environment during normal operation and maintenance.

Silicon Vertex Tracker (SVT)

Water cooling:

An independent, closed loop water cooling system cools the SVT front-end electronics (on-detector). The heat is exchanged is to the STAR Modified Chilled Water System, via a heat exchanger. Total volume of the system is ~45 gallons, the typical volume of water in the system is ~32 gallons. The maximum system pressure is 30 psig, however all elements inside the TPC are run below atmospheric pressure. The nominal flow rate is 5 gpm at a nominal

water temperature of 75 F. The system is located on the first floor of the STAR North platform. No water is released to the environment during normal operation and maintenance.

The SVT RDO boxes are cooled by the TPC closed loop water cooling system. The nominal flow rate through the RDO boxes is 12-19 gpm.

Air Cooling System:

The SVT is air-cooled from outside the TPC wheel. An air manifold is mounted to the TPC wheel. The air is pulled from the Wide Angle Hall (WAH) and pumped into the SVT volume from the West Side of STAR, and released to the WAH on the East Side. The operating pressure is less than 0.8 in. H2O (2 mbar). The shut off pressure is 2 in. H2O (5 mbar)

The nominal temperature is 75 F and the maximum flow rate is 600 cfm (17000 lpm), however we expect much less.

Forward Time Projection Chambers (FTPC)

Gas system:

Gas mixture: Ar/CO2 (50/50)
Purge flow: maximum capacity is 200 l/h
Operational flow: 50 - 100 l/h in purge mode, 100 l/hr in recirculation mode
~20 l/hr vented from system during recirculation.
Exhaust to gas mixing room
Location: Gas mixing room

Water cooling:

Water cooling for FEE and RDO boards.
Supply system is closed circuit at low pressure (leakless) with heat exchanged to MCW system.
Total water volume: < 10 gallons
Flow: < 0.5 g/min
Supply system is located on first level of STAR North platform.
No water release to environment during normal operation and maintenance.

Barrel Electromagnetic Calorimeter Shower Maximum Detector (SMD)

Gas System:

Gas Bottles/Initial Supply Manifold is located immediately outside the door of the gas mixing room at the STAR hall. Bubbler arrays located at 10 o'clock/2 o'clock West positions on STAR magnet backleg steel.

SMD Gas is 90% Argon - 10%Carbon Dioxide at low flow and atm. pressure.
Total Gas Volume ~ 120,000 cm**3 (120 modules @ 1 l/module)

Modules are ganged together in pairs, i.e. 60 modules = 30 pairs

Nominal Flow Rate - 10 cm**3/min /module
Total Nominal Flow rate for FY03 - 600 cm**3/ min

Gas is vented outside magnet through a system of bubblers into the building.

Water Cooling System:
The SMD FEE are cooled by a closed loop water cooling system.
Heat exchange is to the STAR MCW.
Total volume of the SMD modules is ~ 1 liter, total flow rate ~ 100 cc/s.
Cooling water circuit supply/return rings on West end of Magnet.
No water is released to the environment.

Photon Multiplicity Detector (PMD)
Gas System:

The PMD use a gas mixture of 70% Argon and 30% CO2. The gas is purchased from an offsite vendor premixed. It is a single pass gas system, with a flow rate for the entire PMD detector of ~50 l/hour. This gas will be exhausted into the gas mixing room.

Endcap Electromagnetic Calorimeter (EEMC)
Water cooling System:

The EEMC has a stand alone, closed loop water cooling system. The total water volume of the system is ~10 gallons. The heat from the system is dumped into the Wide Angle Hall. No water is released to the environment during normal operation and maintenance.

Time of Flight Patch (TOFp)
Water cooling:
The TOFp tray is cooled using water from the TPC water cooling system.
No water is released to the environment during normal operation and maintenance.

Multigap Resistive Plate Time of Flight Detector (TOFr)
Gas System:
The TOFr gas system has the capability to mix three input gases, Environmentally friendly Freon (R134A), Isobutane, and SF6.

The nominal flow rates for the three gases are:
R134A: 63ccm, Isobutane, 3.5ccm, and SF6, 0-3.5ccm.

The return gas mixture from the detector will be vented to the atmosphere, outside the gas mixing room, through a stack

Silicon Strip Detector (SSD)
Air Cooling system:

The SSD detector employs what is known as a “Vortec” air cooling system to cool the silicon detectors as well as the electronics located on the SSD ladders. This system employs an air compressor to pass high velocity air past an orifice to create an underpressure on one side of the orifice. This underpressure is used to increase the air flow through the SSD ladder by pulling the air supplied by the SVT air cooling system from the IFC region. The air compressor resides in the second floor equipment loft in the Assembly building. The air from the Vortec system is vented (released) into the Wide Angle Hall.

Modified Chilled Water (MCW) System.

Water Cooling System:

N.B. This water cooling system is a C-AD facility system, not a STAR system.

The MCW is a closed loop water system. The heat from the system is exchanged to the Water cooling tower located on the RHIC berm, to the East of the STAR facility. The water flow rate in normal operations is ~ 450 gal/min. No water is released from the system in normal operations and maintenance.

STAR Magnet

Water Cooling System:

N.B. This water cooling system is a C-AD facility system, not a STAR system.

The water cooling of the STAR magnet is done via a closed loop water system. The heat from the system is exchanged to the Water cooling tower located on the RHIC berm, to the East of the STAR facility. The water flow rate in normal operations is ~ 1100 gal/min. No water is released from the system in normal operations and maintenance.